

TP 3706E



CANNON MIXER

DE-ICING DEMONSTRATION - THUNDER BAY



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DE-ICING EXPERIMENT USING ATARA CANNON MIXERS

AT

CANADIAN MALTING TERMINAL

THUNDER BAY

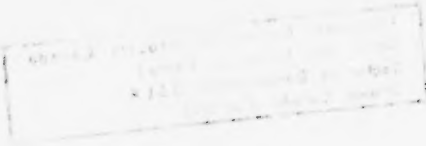
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Transportation Development Centre
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And

Canadian Marine Transportation Administration

April 1982



The contents of this report reflect the views of the contractor and not necessarily the official views or policies of the Transportation Development Centre, Transport Canada.

REPORT DOCUMENTATION FORM

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4. Title and Subtitle De-icing Experiment using ATARA Cannon Mixers at Canadian Malting Terminal, Thunder Bay		5. Report Date APRIL 1982	
		6. Performing Organization Report No.	
7. Author(s) Declan Murphy		8. Transport Canada File No. D1460-145-2-3	
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15. Supplementary Notes		16. TDC Project Officer L.A. McCoomb	
17. Abstract As part of an overall study of ice clearance at Thunder Bay Port, co-ordinated by Transport Canada, Atara Corporation provided and installed 5 Atara Cannon Mixers at the Canadian Malting Dock. These units were put into operation and their ability to reduce the ice coverage was evaluated during the month of March, 1982. Logs were kept by an independent consultant of original ice thickness, rate of removal of ice and energy inputs used. This report covers outline data on the equipment used, its general effect and suggestions on a permanent type of installation.			
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7. Auteur(s) Declan Murphy		8. N° de dossier Transports Canada D1460-145-2-3	
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15. Remarques additionnelles		16. Agent de projet — CDT L.A. McComb	
17. Résumé Dans le cadre du programme d'étude des moyens de déglacage des ports coordonné par Transports Canada, la compagnie Atara a installé 5 de ses mélangeurs statiques à bulles d'air au quai de la société Canadian Malting Ltd., à Thunder Bay. Ces appareils ont été mis en service en mars 1982 afin d'en déterminer les capacités de déglacage des ports. Un consultant indépendant a fait les relevés nécessaires à l'évaluation: épaisseur initiale de la glace, vitesse de déglacage, énergie mise en oeuvre, etc. Ce rapport présente une fiche descriptive des appareils utilisés, décrit leur principe de fonctionnement et présente des suggestions quant à l'aménagement d'installations permanentes de ce type.			
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ATARA "CANNON" MIXER

DE-ICING DEMONSTRATION - THUNDER BAY

PROGRAMME IN GENERAL:

To test the ability of a series of 5 Atara Cannon 305mm dia. mixers to de-ice an area at the Canada Malting Dock, Thunder Bay.

DATES OF EXPERIMENT:

The units were installed on March 5th and were removed on April 14th. The photographs in this report were taken on March 9th and March 24th respectively. This report in outline covers the period March 5th to 24th.

CONCLUSIONS:

The units were successful in de-icing large areas of unusually thick ice (3 m plus) for low horsepower expenditure. The test proved that there is temperature reserve to achieve de-icing. The method of re-floating the units was effective. However the author feels a permanent installation of units is possible and feasible without any interference to ship traffic. Such a permanent installation if installed on both sides of the basin would be capable of reducing ice coverage in the basin to easily handled small floes. Any small ice floes remaining would be in the centre area of the basin and posing no danger to dock sides.

Atara wish to thank Mr. Wayne Ellwood and Mr. Lloyd McCoomb, of Transport Canada, for the opportunity of being involved in these experiments, Mr. Jim Hill, Port Engineer, Lakehead Harbour Commission, Mr. R. Kamo of V.B. Cook Consulting Engineers and Mr. Keegan and his personnel at the Canada Malting Dock for their excellent co-operation and assistance.

D. Murphy

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PART I

DESCRIPTION OF EQUIPMENT USED,
LAYOUT OF UNITS AND GENERAL COMMENTS ON RESULTS

ATARA CORPORATION

PART I

A. EQUIPMENT

1. Atara Cannon Mixers

Five Atara mixers were used each mounted the same distance from the water bottom but with varying lengths of stack pipe as follows:

One unit - .61m (2'0") long
Two units - 3.66m (12'0") long
Two units - 5.79m (19'0") long

The Atara unit is a unique liquid pump using a patented generator to non-mechanically form intermittent piston bubbles from a continuous air source. These bubbles are released into a vertical stack where they act as expendable pistons pumping large volumes of liquid through the stack at low volume horsepower input.

B. 2. Air Lines

These were of reinforced rubber 19mm (3/4") dia. rubber air lines attached to flotation rings on the steel counterweights of the unit. See dwg. 3671-03 and 04.

3. Blower

A Lammert oil-less blower complete with air intake filter, relief valve and a 5.6kW(7.5HP) motor was used. This was contained in a steel casing with motor starter, light and heater. See dwg. 3671-04 for blower.

C. EQUIPMENT LAYOUT

The equipment was installed in the locations shown on dwg. 3671-03. The units were dropped in through .76m(2'6") square holes cut in the ice. The air flow to the units was balanced as shown below so that differences in the air supply to each unit could be roughly measured later against efficiency in ice removal.

D. AIR SUPPLY & HORSEPOWER

The blower, working under site conditions is estimated to supply a total of $1.4\text{m}^3/\text{min}$ (50 SCFM) at 68.9kPa (10 PSI).

By evaluation of bubble emission intervals the air supply to each unit at the time of start-up was set as follows:

<u>Unit No.</u>	<u>Emission Interval</u>	<u>m^3/min</u>	<u>SCFM</u>
1	3 sec.	.47	16.50
2	8 sec.	.18	6.25
3	4 sec.	.35	12.50
5	6 sec.	.23	8.25
4	8 sec.	<u>.18</u>	<u>6.25</u>
Total		$1.4\text{m}^3/\text{min}$ [†]	50 SCFM

We estimated the blower was drawing 4.5 to 4.8kW (6.0 to 6.5) brake horsepower to produce these emission rates.

GENERAL COMMENTS ON RESULTS

It should be noted that the comments noted here are from field visits of the following Atara personnel:

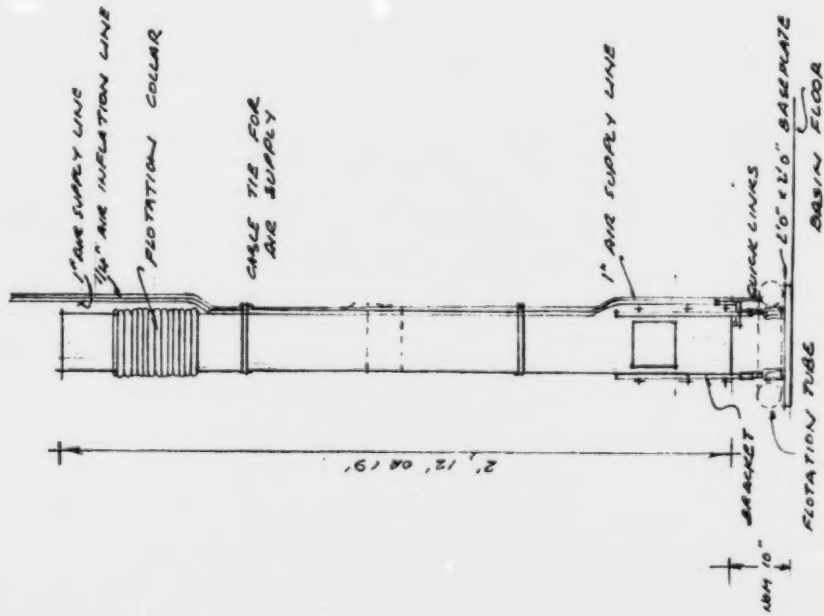
Michael Poole and Declan Murphy of Atara Corporation.

They are comments only and should be noted as being secondary to the in-depth study undertaken at the same period by V.B. Cook Co. Ltd., Consultants, Thunder Bay.

1. It is our opinion that there is sufficient thermal reserve in the lower liquid levels to warrant liquid displacement type de-icing. M. Poole, using a long scale tip-over Negretti & Zambra thermometer, measured a plus difference of almost 1°C between bottom and surface water.
2. Straight vertical emission of the displaced bottom liquids may not be the most efficient way of using this thermal reserve. The effect looks good with the visual appearance of the open water areas, but this also goes hand in hand with major thermal losses to ambient air in the open areas. This was very evident in Thunder Bay this year with the unusually cold spring.

GENERAL COMMENTS (cont'd)

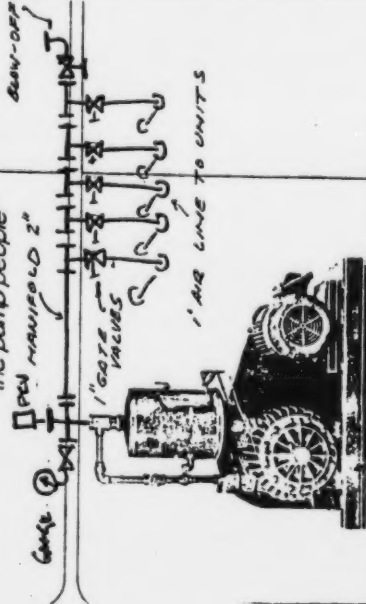
3. While the removal of the Atara units using the flotation collar worked successfully we feel that the system should be a permanently installed system and only require a simple switch-on, switch-off process each year.
4. The system should provide for horizontal flow emissions from the dispersal unit so that erosion of ice can take place without unnecessary areas of open water being developed during de-icing.
5. Units #2 and #4 which were fed a lower volume of air did not clear as much ice as the dock side units. The performance of these units may have also been affected by the facts that:
 - a) there may be a greater thermal effect near the dock through released heat diffusion from the earth mass of the dock itself.
 - b) the Saskatchewan Pool at the time of the test introduced high volume high pressure air discharges into several areas on their side of the basin. It looked as though they discharged this air at a short distance below the surface. In fact some of this air was visible escaping in the opening created by unit #4. We feel that perhaps their air emission was discharging super-cooled water towards the centre area of the basin and nullifying some of the effects of units #2 and #4.



DARA UNIT

from **Lammert**

"the pump people"



COMPRESSOR GRAPHIC

DWG. NO.

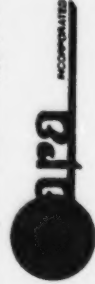
TITLE

REFERENCE DRAWINGS

DE-ICING EXPERIMENT
THUNDER BAY ONT.

PROJECT NO. 871

EQUIPMENT ITEMS



DRAWN APPROVED DATE 4/11/82 SCALE

REV

NO. 3671-09-82

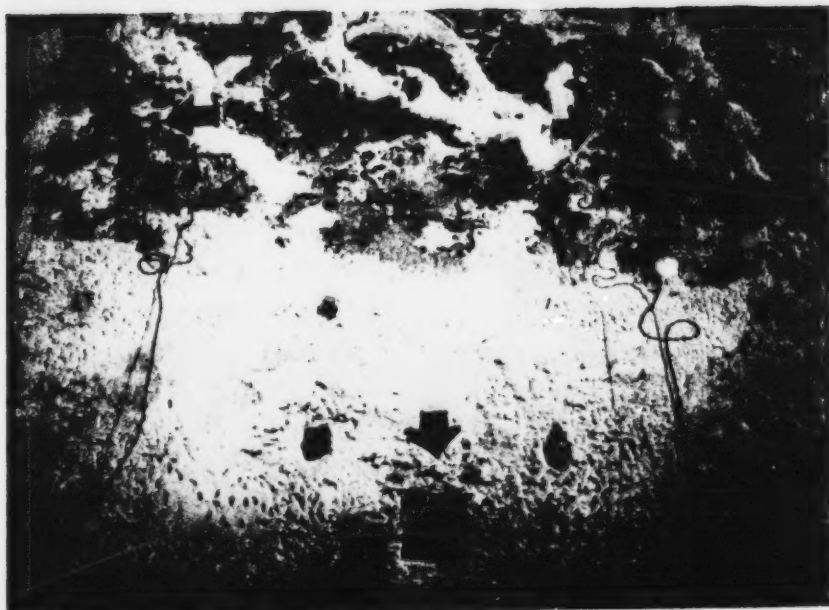
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ATARA CORPORATION

CANADA MALTING
DOCK



INSERTION HOLES
UNITS # 2, 3 & 4.



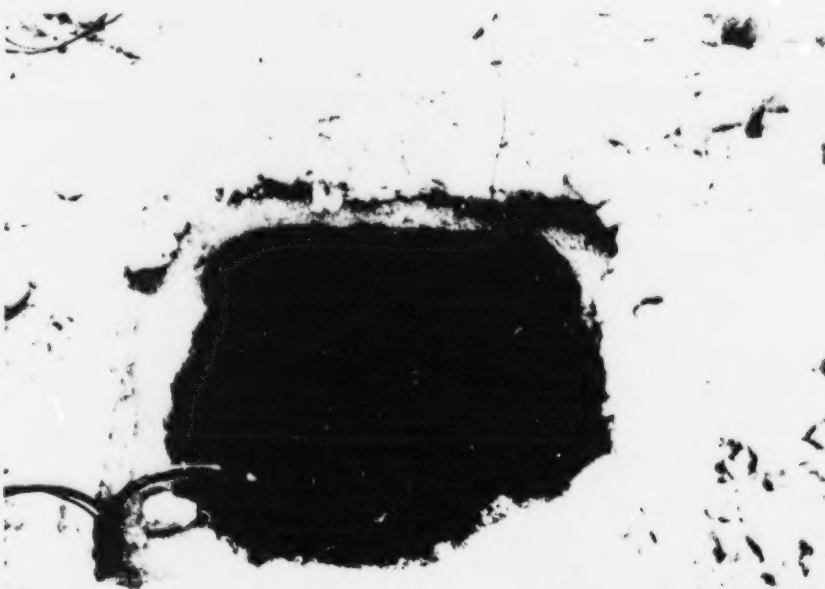
19' UNIT
2



MARCH 5TH 1982

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TYPICAL INSERTION
HOLE



2' LONG UNIT
1



TYPICAL
INSERTION HOLE



MARCH 5TH 1982

ATARA CORPORATION

12' LONG UNIT

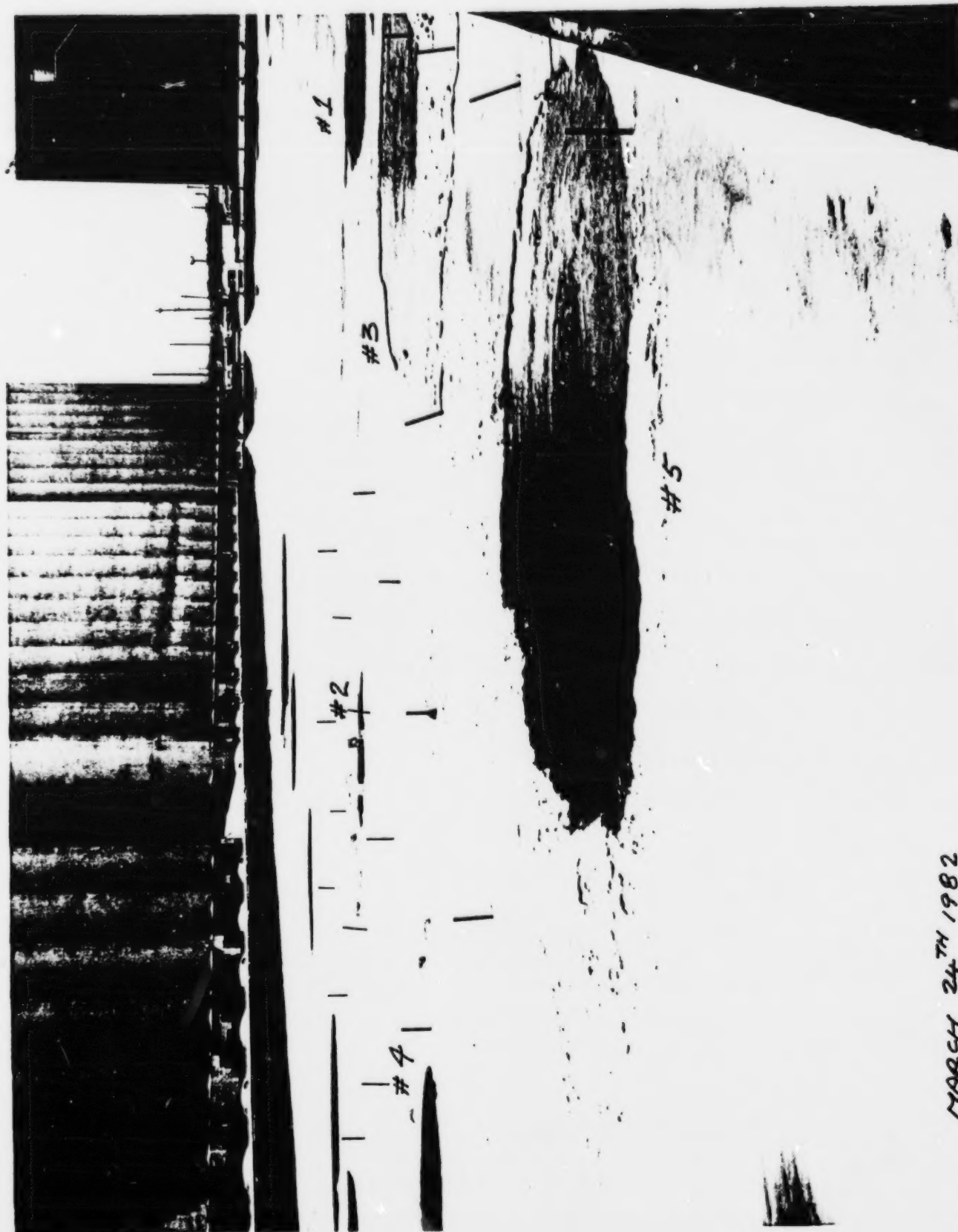
3



LAMBERT BLOWER & HOUSING



ATARA CORPORATION



MARCH 24TH 1982

ATARA CORPORATION



I

ATARA CORPORATION



#3

#2

MARCH 29TH 1982

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PART II

PROPOSED PERMANENT INSTALLATION OF
DE-ICING SYSTEM

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PERMANENT DE-ICING SYSTEM

Atara would propose permanently installing a series of units located snugly against the present sheet steel piling and protected by this piling. The required main air supply line would be located under the present concrete bulkhead with a main header from this air supply line back into the workhouse area at the silos. This arrangement could be set up to use plant air.

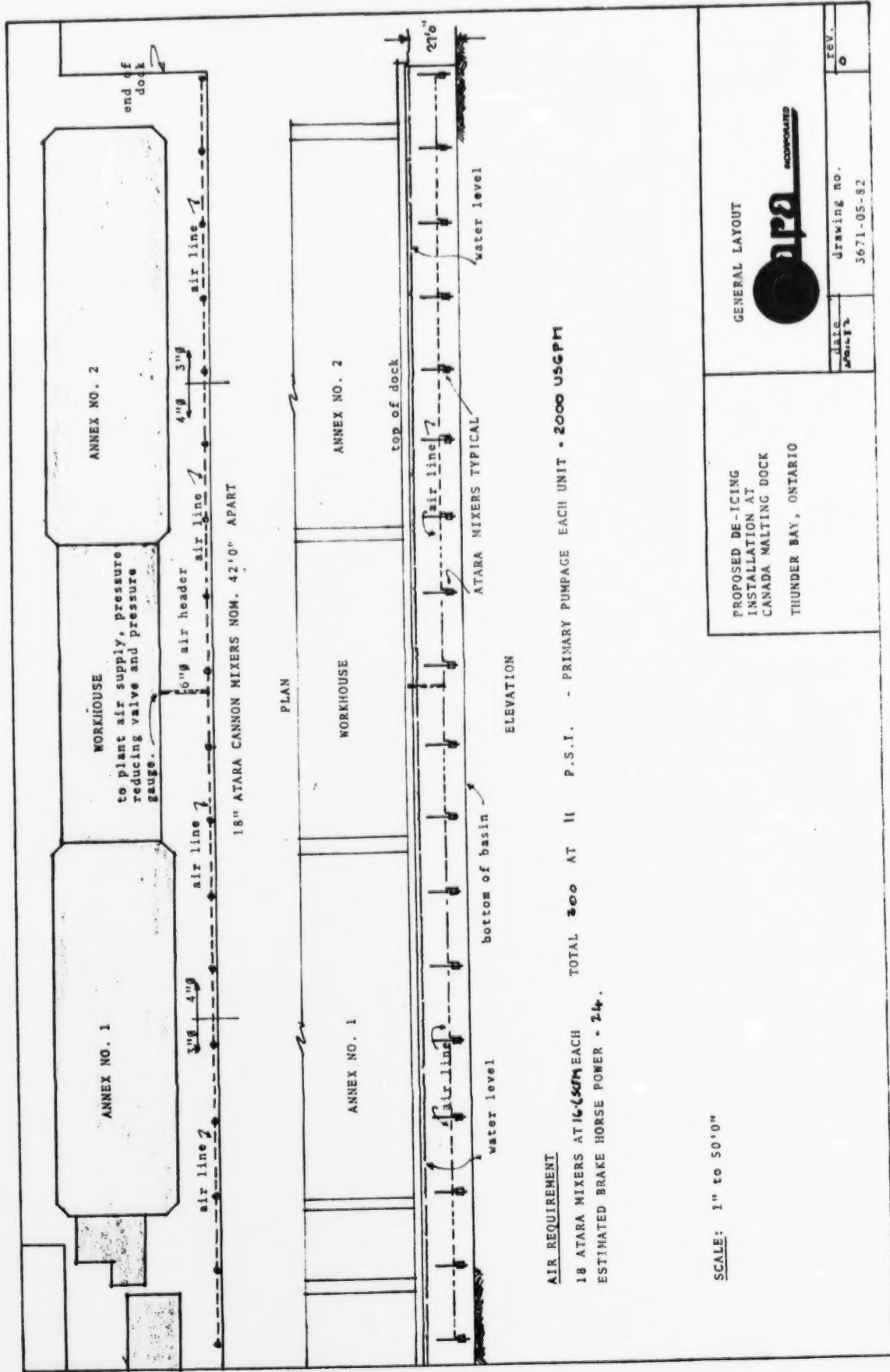
The units would be supplied with deflection heads so that positive horizontal flow would be induced into the liquid being taken from the bottom. This flow would, in time, affect areas out to the centre of the basin.

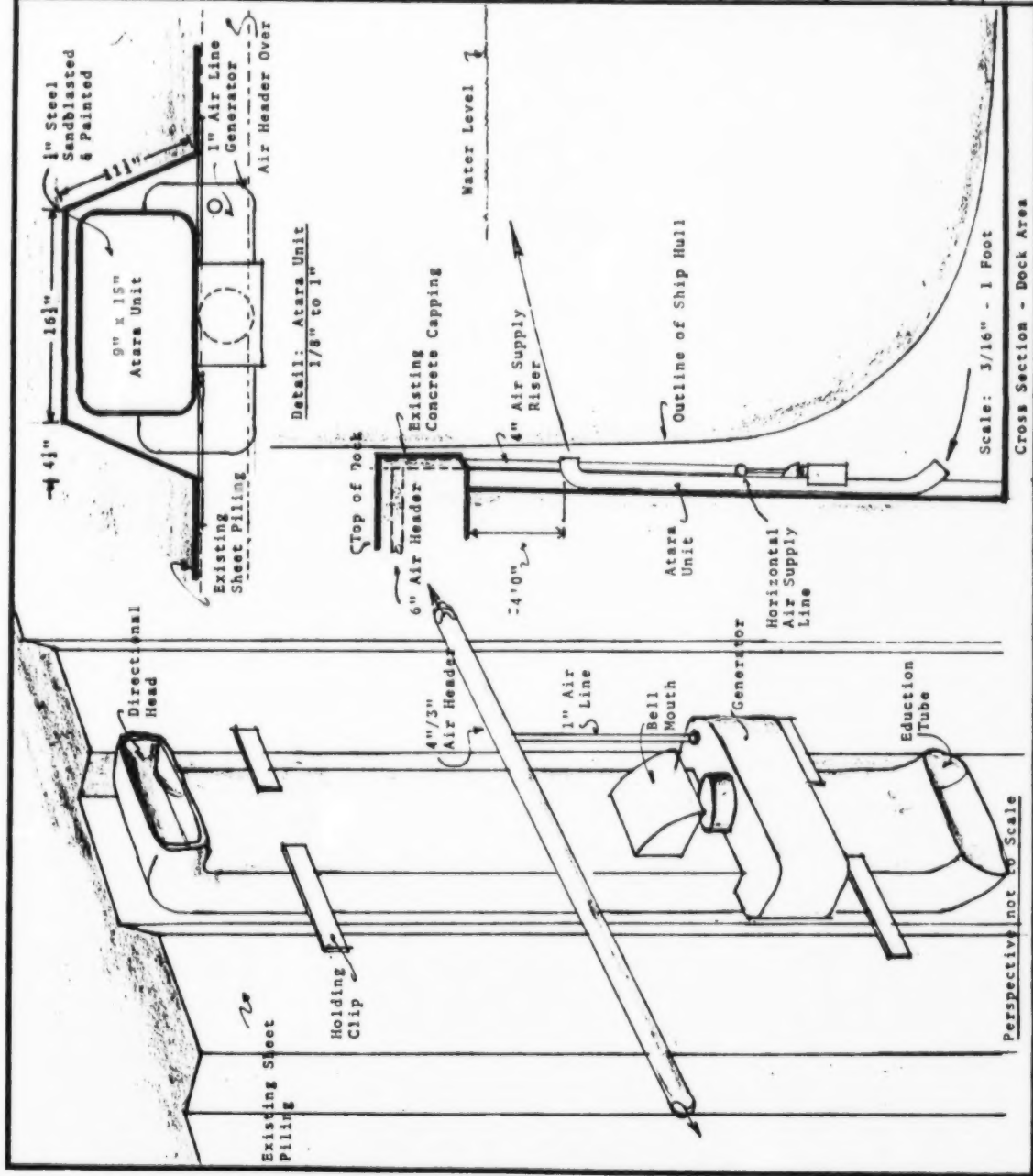
Drawings #3671-05-82 and #3671-06-82 show the unit design and layout proposed as typical for the Canada Malting Dock.

It is estimated that the total installation will require $8.5 \text{ m}^3/\text{min}$ (300 SCFM) at 75.8 kPa (11.0 PSI). This would translate into approximately 17.9 kW (24 brake horsepower).

If the proposal is of interest we could develop capital cost estimates for the supply and installation of the system outlined.

D. Murphy,
Vice-President &
General Manager

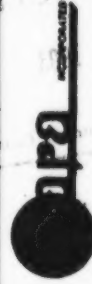




DWG. NO. TITLE
REFERENCE DRAWINGS

ATARA CANNON MIXER
INSTALLATION DETAILS

PROJECT NO. 3671



PROPOSED DE-ICING
INSTALLATION AT
CANADA MALTING DOCK
THUNDER BAY, ONTARIO

DRAWN APPROVED DATE SCALE

NO. 3671-06-82 REV. 0